

by any people except physiologists, and even by them only in a doubtful sort of way, for they thought that its indication gave merely the period and direction of a sudden change of P.D., and they feared that the magnitude of the variation could not be deduced from the excursion of the meniscus formed, at the junction of the threads of mercury and dilute sulphuric acid.

It may be well to mention that we use the letters "P.D.," not merely because they appear to us to be a convenient abbreviation for "potential-difference," but because Mr. Burch, by employing them throughout his book, shows that he has the same opinion.

The book commences with a description of the best methods of constructing a capillary electrometer to which the author's experience has led him, and the reader is warned regarding the faults which he is likely to meet with in the practical use of the instrument, and instructed how to overcome those that can be remedied without making a new instrument.

The first two points that Mr. Burch determined to ascertain experimentally, when he began his work on the capillary electrometer in 1886, were: (1) Does any current pass through the instrument after the meniscus in the capillary tube has reached its stable position for the particular P.D. applied; and (2) does any leakage take place through the instrument if the applied P.D. be withdrawn after the meniscus has been deflected? To each of these questions experiment gave a negative answer, and he was, therefore, led to the conclusion that, although the circuit of a capillary electrometer is composed entirely of conducting substances, and, although there is no visible insulating dielectric, the instrument transmits no current with a P.D. of less than 0.5 volt, but merely receives and maintains a charge as if it were a well-insulated condenser.

The capacity of different capillary electrometers was found by the author to vary between 0.1 and 30 microfarads, but instruments having a capacity of between 0.5 and 2 microfarads gave the best results. When the capacity is unchanged on moving the mercury thread through a considerable portion of the capillary tube the electrometer is found to be equally sensitive throughout that part of the tube.

The author concludes that this instrument is essentially adapted to the poor man, since its cost, including that of the microscope, is less than that of any other electrometer of the same sensibility. It also has the advantage of responding with extreme rapidity to every change of potential.

Various methods are described in detail for obtaining records on photographic plates, having a rapid linear or circular motion, and the author shows how the instantaneous value of a rapidly varying P.D. can be deduced at any point of the photographic curve from the fact, which he proves, viz. that the value of the applied P.D. is measured at any moment by the instantaneous distance of the meniscus from the zero position *plus* the rate of motion of the meniscus at that moment. And in the case of the photographic plate moving circularly, he points out that the second term, depending on the instantaneous value of the velocity of the meniscus, is given by the length of the subnormal to the curve at the particular point.

The book concludes with some interesting examples of curves obtained with telephones, direct and alternate current dynamos, &c., from which the value of the capillary electrometer may be clearly seen.

The reasoning in some parts of the book is not very clear; and, while the figures of the parts of the apparatus itself are in many cases bold and well executed, those illustrating the geometrical reasoning, and the results obtained with the photographic plates, are not as intelligible as one would like. We hope to see Part ii. of this book at an early date; and, for the benefit of those who do not resemble the author in being masters in the use and the theory of the capillary electrometer, we trust that he will not hesitate to sacrifice compression to clearness. W. E. A.

OUR BOOK SHELF.

A Handbook to the Geology of Cambridgeshire, for the Use of Students. By F. R. Cowper Reed, M.A., F.G.S. 8vo. Pp. x2 + 76. (Cambridge: at the University Press, 1897.)

THE geology of Cambridgeshire possesses a special interest for many students. From Cambridge itself there have sprung a greater number of expert British geologists than from any other seat of learning in this country. Though founded by John Woodward, the school was created by Sedgwick; and it has been carried on with signal success by Prof. Hughes. This success, as the present Professor has cordially acknowledged, is partly due to the band of brilliant assistants he has gathered around him. Thus special instruction is given in all branches of geology, and the author of the present work has during recent years rendered aid in the department of stratigraphical palæontology. To a casual visitor the scenery and geology of Cambridgeshire may offer but few attractions, for the country is mostly low-lying, and there is much clay-land and fen. Oxford affords a greater variety of scenery and a more attractive series of fossiliferous formations. Nevertheless, there is much in Cambridgeshire geology to arouse interest when once an enthusiasm for the science has been kindled, and there was need of a concise handbook which should clearly describe and explain the leading facts that have been made known. The excellent "Sketch" by Prof. Bonney dates back to 1875, and the more detailed geological survey memoir on the neighbourhood of Cambridge, by Penning and Jukes-Browne, was issued in 1881. The present work is a model of what a county geology should be. The zones in the Jurassic and Cretaceous rocks, the phosphatic nodules in Lower Greensand and Chalk, the glacial deposits, valley-drifts, and recent accumulations, are all duly described and accompanied by full records of the fossils. If we find fault at all, it is that the author has entered at too great a length into certain contrary views regarding the formation of the Chalky Boulder Clay, for the extraordinary "diluvial theory," as he himself admits, "finds few supporters at the present time." Even the view of S. V. Wood, jun. (noted on p. 168), was modified in that geologist's latest publication.

Our author rightly wanders a little out of the county to give some account of the Red Chalk of Hunstanton, because it is so frequently visited by Cambridge students.

Brief chapters are given on the antiquity of man and on water supply. With regard to the latter subject, we would question the statement (quoted by the author) that "if the Oxford Clay was pierced we might reasonably expect an abundant supply of water." The outcrop of Lower Oolites is some distance away, while at St.

Neots the water that was obtained at a depth below the surface was saline in character. A full and useful bibliography completes this excellent and well-arranged work.
H. B. W.

Wild Traits in Tame Animals. By Louis Robinson, M.D. Pp. vii + 329. Illustrated. (Edinburgh and London: Blackwood and Sons, 1897.)

DR. ROBINSON points out in his introduction that the amateur naturalist is a valuable and necessary member of the scientific community. He detects a tendency on the part of the professional naturalist to warn the amateur off the ground. Whether any such mischievous claim of proprietorship is actually set up is not clear to us; the naturalist who pursues his hobby for recreation only is, according to our own experience, welcomed by everybody, if only he is a good fellow, who will bring in his own contributions, great or small, to the general stock, and not spread false information. Dr. Robinson's animated defence of the amateur naturalist may therefore be gladly allowed to prevail; we are only surprised to learn that any defence is needed.

Our author holds that no one in these days can study animals with due profit who is not a Darwinian; he would have his amateur naturalist "an evolutionist down to the tips of his toes." We are not so heartily on his side here. There is risk of spoiling a quick and trustworthy observer by saturating his mind with theories. If natural facts are reported to us, they do not gain in credibility by being expressed in evolutionary phrase. It is good that every naturalist should think upon his facts, but let him think independently, not as an evolutionist, nor as a partisan of any school whatever.

We like the papers which form the bulk of the book much better than the introduction. Dr. Robinson discourses upon dogs, horses, donkeys, cattle, sheep, goats, pigs, cats and poultry. The first two of these seem to us the most interesting, but all possess good points. The author gives us a lively object-lesson upon each animal, trying to explain its structure and habits by the mode of life of its wild progenitors. Very many of his interpretations have been anticipated; that is to be expected; but everything is cast into a new and engaging form; it reads like personal experiences illuminated by the writer's own reflections. No reader who thinks for himself will accept all Dr. Robinson's conclusions, but he will find his interest in the subject heightened, and his sagacity exercised by these amusing dissertations.

L. C. M.

The Psychology of the Emotions. By Th. Ribot. Pp. xix + 455. (London: Walter Scott, Ltd., 1897.)

IN this book Prof. Ribot gives a very complete account of his subject. In the first part he deals with pleasure and pain and the general nature of emotion. He advocates a theory of emotion which he terms "physiological." Feeling is regarded as a primary aspect of mental life, closely connected with biological conditions; and the author seems to think that it is hopeless in this region of psychology, at any rate, to depend wholly on purely psychological methods, the subject only becoming intelligible by going beyond consciousness and treating it in its physiological relations. As part of this general theory Prof. Ribot adopts, with some qualification, the theory illustrated by James in the words, "we feel sorry because we cry, angry because we strike, afraid because we tremble." In the second part, dealing with the special forms of emotion, no attempt is made to give an elaborate classification; but the chief aspects of emotional life are described in the order in which they seem to have developed. In this part, and especially in the chapters on character and temperament, the author brings out the great value of pathology in the study of psychology.

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LETTERS TO THE EDITOR

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The Passive Condition of Resting Protoplasts.

THE appearance in your last issue of a short paper recently communicated to the Royal Society by myself and Mr. F. Escombe, on the "Influence of very Low Temperatures on the Germinative Power of Seeds," affords me an opportunity of calling attention to two important papers which only became known to us after our own was in print. Both these communications materially strengthen the argument against the necessary existence in resting protoplasts of ordinary respiratory exchanges, or of any metabolic changes resulting in "intra-molecular respiration."

The first paper is by W. Kochs (*Biol. Centralbl.*, 10 (1890), 673), who has shown that dry seeds, placed for many months in the vacuum of a Geissler's tube, do not evolve an amount of carbon dioxide or nitrogen capable of detection by subsequent spectroscopic examination of the contents of the tube, a fact which certainly negatives the idea of any gaseous evolution by "intra-molecular respiration."

The other omission is one which is much less excusable, since it has reference to a very important letter communicated to your columns by Prof. Giglioli as recently as October 3, 1895.

In continuation of certain experiments, described in 1878, on the power of resistance of seeds of *Medicago sativa* to the action of certain gaseous and liquid chemical reagents, Prof. Giglioli re-examined the seeds which had been placed under these special conditions continuously for a period of more than sixteen years. He found that some of the seeds retained their vitality even when surrounded by atmospheres of nitrogen, chlorine, hydrogen, arseniuretted hydrogen, and nitric oxide; whilst immersion for sixteen years in strong alcohol, and in an alcoholic solution of mercuric chloride, still left a large number of seeds capable of subsequent germination.

That we have been anticipated in some of the conclusions of our paper, based on a totally different method of experiment, will be clearly seen from the following quotations from Prof. Giglioli's letter:—

"My experiments encourage, moreover, the suspicion that latent vitality may last indefinitely when sufficient care is taken to prevent all exchange with the surrounding medium." . . . "It is a common notion that life, or capacity for life, is always connected with continuous chemical and physical change. The very existence of living matter is supposed to imply change. There is now reason for believing that living matter may exist, in a completely passive state, without any chemical change whatever, and may therefore maintain its special properties for an indefinite time, as is the case with mineral and all lifeless matter. Chemical change in living matter means active life, the wear and tear of which necessarily leads to death. Latent life, when completely passive, in a chemical sense, ought to be life without death."

Prof. Giglioli concludes his letter with a reference to the possibility of an extra-terrestrial origin of life on the earth, through the medium of meteorites.

HORACE T. BROWN.

52 Neven Square, Kensington, December 13.

Discovery of a Large Supply of "Natural Gas" at Waldron, Sussex.

THE discovery of this gas occurred accidentally while boring for water in the parish of Waldron, Sussex. The boring was commenced in the lower strata of the "Ashdown sand" (Hastings beds), and was continued to the depth of 377 feet, when the work was stopped. A strong smell of "gas" having been noticed, a light was applied to the top of the lining tube of the bore, and a flame immediately sprang up to the height of 15 or 16 feet, and burned with great fury until it was put out by means of damped cloths being thrown on to the top of the tube (Fig. 1).

It is not quite certain at what level the first release of the gas occurred; and the workmen say that they noticed the smell of it for nearly a month before the testing with a light occurred, during which time boring was carried on.